

Appl. No. 09/508,512
Amendment dated: October 22, 2003
Reply to OA of: July 31, 2003

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1(currently amended). A hygroscopic scintillator element suitable for selective response to tritiated water vapour and other hydrophilic tritiated species in a gas, which scintillator comprises a solid scintillator material having a layer of hydroscopic material thereon, said hygroscopic material comprising an aqueous or gel solution of a deliquescent salt, base or organic salt or an inorganic or organic substance which can adsorb water, or a combination of any of said substances.

2(previously presented). A scintillator element according to claim 1 wherein said solid scintillator material comprises any of, a plastic, an inorganic phosphor, an oxide based material, a glass or a combination of these materials.

Claim 3(canceled).

4(original). A scintillator element according to claim 1 wherein said hygroscopic layer is from 0.4 to 1 micron in thickness.

Claim 5(canceled).

6(previously presented). A scintillator element according to claim 1 wherein said hygroscopic material is selected from the group consisting of zinc chloride, potassium acetate, phosphoric acid and lithium chloride.

7(previously presented). A scintillator element according to claim 1 which further comprises a hydrated solid such as zeolite.

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8(previously presented). A scintillator element according to claim 1 which is in the form of a sheet, fibre, rod, spiral roll, powder, a powder compact, varnish, paint or a combination thereof.

9(currently amended). A method for making a hygroscopic scintillator element, suitable for selective response to tritiated water vapour or other hydrophilic tritiated species in a gas, ~~which said method comprising the steps of: comprises coating a solid scintillator material with a layer of a hygroscopic material the solid scintillator material having been pretreated with a detergent or been subjected to a hydrophilic surface treatment.~~

providing a scintillator material that has either been pretreated with a detergent or subjected to a hydrophilic surface treatment; and

coating said scintillator material with a layer of a hygroscopic material comprising an aqueous or gel solution of a deliquescent salt, base or organic salt or an inorganic or organic substance which can adsorb water, or a combination of any of said substances.

10(original). A method according to claim 9 wherein said pre-treating step comprises sulfonation.

11(currently amended). A method for monitoring the activity of tritiated water vapour or other hydrophilic tritiated species in a gas, which method comprises:

(a) ~~providing a hygroscopic scintillator element according to claim 1 for contact with a gas to be tested, said scintillator element comprising a solid scintillator material having a layer of hygroscopic material thereon, said hygroscopic material comprising an aqueous or gel solution of a deliquescent salt, base or organic salt or an inorganic or organic substance which can adsorb water, or a combination of any of said substances;~~

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(b) measuring the light emitted from said hygroscopic scintillator using measuring means, the amount of said light emitted from said scintillator element providing a measure of the activity of the tritiated water vapour or said hydrophilic tritiated species in the gas.

12(previously presented). A method according to claim 11 wherein said hygroscopic scintillator is provided in an aperture in the wall of a substantially light-tight plant containing said gas, a suitable window or aperture being provided to allow said measuring means to measure only light emitted from the said hygroscopic scintillator element.

13(original). A method according to claim 11 wherein said hygroscopic scintillator element is provided in a substantially light-tight container, which incorporates an inlet adapted to allow the access of said gas to said element and which prevents light entry to or escape from said container.

14(previously presented). A method according to claim 13 which container additionally includes an outlet to allow passage of said gas therethrough.

15(previously presented). A method according to claim 9 wherein the light emitted by said hygroscopic scintillator is measured remotely by measuring means spatially separated from said hygroscopic scintillator, but optically connected thereto.

16(previously presented). A method according to claim 11 wherein the time averaged output of the measuring means is measured as a continuous current, and used to indicate the tritium radiotoxicity of said gas, and/or its tritiated water activity on a meter, a digital display as an audible signal, and/or as an output to a computer, data logger, recorder, control system.

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17(previously presented). A method according to claim 15 wherein said measuring means comprises one or more photomultiplier tubes, multichannel plates or photodiodes.

18(previously presented). A method according to claim 17 wherein the rate of signal pulses from said measuring means is measured and used to indicate the tritium radiotoxicity of said gas, and/or its tritiated water activity, on a meter, a digital display as an audible signal, and/or as an output to a computer, data logger, recorder, or control system.

19(previously presented). A method according to claim 17 wherein more than one photomultiplier tube, multichannel plate or photodiode is provided.

20(previously presented). A method according to claim 11 which further comprises using a non-discriminating tritium monitor in order to measure, by difference, the activities in said gas of both tritiated water and elemental tritium.

21(previously presented). A method according to claim 20, wherein the non-discriminating monitor is substantially identical to the scintillator element with the exception that the hygroscopic layer is omitted in the non-discriminating monitor.

22(previously presented). A method according to claim 9 wherein said gas to be measured is air.

23(currently amended). Apparatus for monitoring the activity of tritiated water vapour and other hydrophilic tritiated species in a gas, which apparatus comprises:

(a) a hygroscopic scintillator element ~~according to claim 1~~ comprising a solid scintillator material having a layer of hygroscopic material thereon, said hygroscopic material comprising an aqueous or gel solution of a deliquescent salt, base or organic

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salt or an inorganic or organic substance which can adsorb water, or a combination of any of said substances; and

(b) means for measuring light emitted from said hygroscopic scintillator element, the amount of light emitted from said scintillator element providing a measure of the tritium containing species in said gas.

24(original). Apparatus according to claim 23 wherein said scintillator element is provided in a substantially light tight container including inlet means adapted to allow the gas to contact the scintillator element without permitting entry or exit of light to or from said container.

25(previously presented). Apparatus according to claim 23 which further comprises means for containing said gas with said hygroscopic scintillator element.

26(previously presented). Apparatus according to claim 23 which further comprises an outlet in said container to allow passage of said gas or vapour therethrough.

27(previously presented). Apparatus according to claim 25 which comprises a pump to facilitate the passage of gas through said container.

28(previously presented). Apparatus according to claim 23 wherein the light emitted by said hygroscopic scintillator element is measured remotely by said light measuring means spatially separated from said hygroscopic scintillator, but optically connected thereto by means of a light guide.

29(previously presented). Apparatus according to claim 23 wherein said scintillator element is provided in the form of a sheet, fibre, rod, spiral roll, powder, a powder compact, varnish, paint, or a combination of said forms.

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30(previously presented). Apparatus according to claim 23 wherein said measuring means comprises one or more photomultiplier tubes, multichannel plates or photodiodes.

31(original). Apparatus according to claim 30 wherein the rate of signal pulses from said measuring means is measured and used to indicate the tritium radiotoxicity of said gas, and/or its tritiated water activity, on a meter, a digital display, as an audible signal and/or as an electrical output to a computer, data logger, recorder or control electronics.

32(original). Apparatus according to claim 30 wherein a plurality of a photomultiplier tube, multichannel plate or photodiode is provided.

33(previously presented). Apparatus according to claim 31 wherein the time averaged output of said measuring means is measured as a continuous current, and used to indicate the tritium radiotoxicity of said gas on a meter, a digital display as an audio signal, and/or as an output to a computer, data logger, recorder, control system.

34(previously presented). Apparatus according to claim 23 which further comprises a non-discriminating tritium monitor so as to measure, by difference, the concentrations in said gas or vapour of both tritiated water or other possible hydrophilic species and elemental tritium or other hydrophobic radioactive species present.

35(previously presented). Apparatus, according to claim 34, wherein said non-discriminating monitor is substantially identical to a scintillator element with the exception that the hygroscopic layer is omitted in the non-discriminating monitor.

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36(previously presented). Apparatus according to claim 23 which further comprises a second sealed radiation monitor to compensate for background radiation fields, by subtraction.

37(previously presented). Apparatus according to claim 36 wherein said sealed radiation monitor is substantially identical to the scintillator and sealed in a container free of radioactive gas.

38(original). Apparatus according to claim 23 wherein the gas to be monitored comprises air.

39(original). Apparatus according to claim 23 which is incorporated in a breathing mask.

40(previously presented). A scintillator element according to claim 1 wherein said solid scintillator material is doped zinc sulphide.

41(previously presented). A method according to claim 16 wherein said measuring means comprises one or more photomultiplier tubes, multichannel plates or photodiodes.